

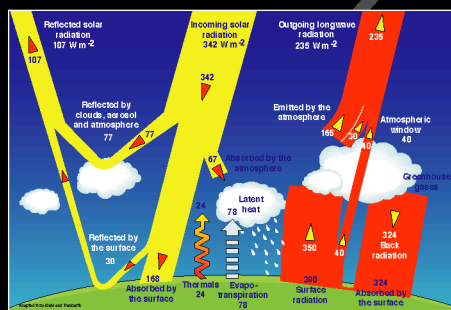


# CERES Aqua

## CERES: Clouds and the Earth's Radiant Energy System

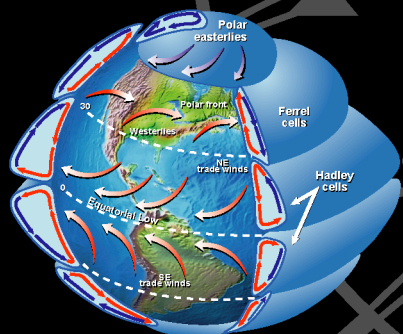
CERES is part of NASA's Earth Observing System, an international program for studying the Earth from space to improve our scientific understanding of global climate change.

## CERES and the Physics of Climate



Earth's Radiation Budget

Sunlight is the fuel that drives the Earth's climate engine. The planet constantly tries to maintain a balance between incoming energy from the sun and outgoing energy that flows from Earth to space. Scientists call this balance the Earth's radiation budget.

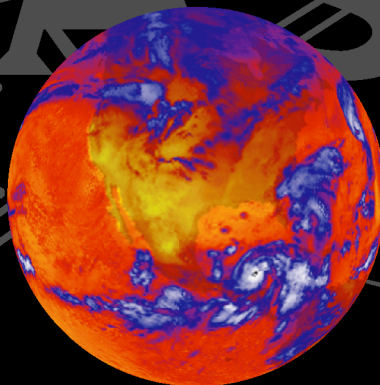


Researchers consider clouds one of the biggest uncertainties in predicting climate change. Changes in clouds are powerful enough to alter Earth's major atmospheric circulation systems and impact the climate engine. In general, warm air at the equator rises and circulates towards the cooler polar regions via the Hadley and Ferrel cells.

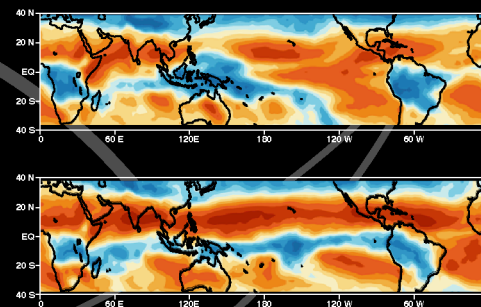
## CERES Science



CERES measures the amount of sunlight reflected back to space by the Earth. The remaining sunlight heats the planet's surface and atmosphere. Clouds have a cooling effect on the climate by reflecting sunlight.



The Earth warms from incoming sunlight and must emit heat to the much colder regions of space. CERES sensors detect the amount of heat leaving the planet. In the above image from September 30, 2000, clear, warm regions, shown in yellow over much of the U.S., emit the most energy. High, cold clouds, shown in blue, reduce the heat lost to space. Areas of white around the eye of Hurricane Keith, south of the U.S., transfer the least amount of heat to space.



Long-term CERES measurements are critical for observing periodic large-scale climate events such as El Niño. The top figure from February 1986 shows a normal distribution of emitted energy. Contrast it with the bottom figure from 1998, an El Niño year. The blue area of high cloud cover, previously confined to the southwestern Pacific Ocean, now stretches across the ocean to South America.

## Outreach and Commercial Applications



The CERES project partially supports an educational outreach initiative called S'COOL or Students' Cloud Observations On-Line. In five years, S'COOL has reached over 1000 schools in 50 states and 57 other countries on five continents. CERES also provides information about weather and sunlight at the Earth's surface for the renewable energy industry via an innovative web site at <http://eosweb.larc.nasa.gov/sse/>.

For more information, see the CERES Web site:  
<http://asd-www.larc.nasa.gov/ceres/ASDceres.html>